SVENSK STANDARD

SS-EN IEC 60567, utg 4:2024

2024-09-25

COMMENTED VERSION

Oljefylld elektrisk utrustning – Provtagning på gas och olja för analys av fria och lösta gaser – Vägledning

Oil-filled electrical equipment – Sampling of gases and analysis of free and dissolved gases – Guidance

En så kallad ”Commented Version” (CMV) innehåller både den fastställda IEC-standarden och en kommenterad och ändringsmarkerad standard. Alla tillägg och borttagningar sedan den tidigare utgåvan är markerade med färg. Med en CMV sparar du mycket tid när du ska identifiera och förklara aktuella ändringar i standarden. SEK Svensk Elstandard kan bara ge ut CMV i de fall den finns tillgänglig från IEC.

IEC 60567

Edition 5.0 2023-12
COMMENTED VERSION

INTERNATIONAL STANDARD

colour inside

Oil-filled electrical equipment – Sampling of free gases and analysis of free and dissolved gases in mineral oils and other insulating liquids – Guidance

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 29.040.10

ISBN 978-2-8322-7996-0

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

OIL-FILLED ELECTRICAL EQUIPMENT – SAMPLING OF FREE GASES AND ANALYSIS OF FREE AND DISSOLVED GASES IN MINERAL OILS AND OTHER INSULATING LIQUIDS – GUIDANCE

FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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This commented version (CMV) of the official standard IEC 60567:2023 edition 5.0 allows the user to identify the changes made to the previous IEC 60567:2011 edition 4.0. Furthermore, comments from IEC TC 10 experts are provided to explain the reasons of the most relevant changes, or to clarify any part of the content.

A vertical bar appears in the margin wherever a change has been made. Additions are in green text, deletions are in strikethrough red text. Experts' comments are identified by a blue-background number. Mouse over a number to display a pop-up note with the comment.

This publication contains the CMV and the official standard. The full list of comments is available at the end of the CMV.

IEC 60567 has been prepared by IEC technical committee 10: Fluids for electrotechnical applications. It is an International Standard.

This fifth edition cancels and replaces the fourth edition published in 2011. This edition constitutes a technical revision. 1

This edition includes the following significant technical changes with respect to the previous edition:

a) a new normative Annex F relating to DGA analysis of insulating liquids other than mineral oils (esters and silicones) has been added;
b) Clause 4 to Clause 11 and informative Annex A to Annex E remain devoted to mineral oils;
c) two new mercury-free gas extraction methods are described in Annex B (low pressure vacuum extraction and mechanical oscillation).

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INTRODUCTION

Gases ~~may~~ can be formed in oil-filled electrical equipment due to natural ageing but also, to a much greater extent, as a result of faults.

Operation with a fault ~~may~~ can seriously damage the equipment, and it is valuable to be able to detect the fault at an early stage of development.

Where a fault is not severe, the gases formed will normally dissolve in the oil, with a small proportion eventually diffusing from the liquid into any gas phase above it. Extracting dissolved gas from a sample of the oil and determining the amount and composition of this gas is a means of detecting such faults, and the type and severity of any fault ~~may~~ can often be inferred from the composition of the gas and the rate at which it is formed.

In the case of a sufficiently severe fault, free gas will pass through the oil and collect in the gas-collecting (Buchholz) relay if fitted; if necessary, this gas may be analysed to assist in determining the type of fault that has generated it. The composition of gases within the bubbles changes as they move through the oil towards the gas-collecting relay.

This can be put to good use, as information on the rate of gas production ~~may~~ can often be inferred by comparing the composition of the free gases collected with the concentrations remaining dissolved in the liquid.

The interpretation of the gas analyses is the subject of IEC 60599.

These techniques are valuable at all stages in the life of oil-filled equipment. During acceptance tests on transformers in the factory, comparison of gas-in-oil analyses before, during and after a heat run test can show if any hot-spots are present, and similarly analysis after dielectric testing can add to information regarding the presence of partial discharges or sparking. During operation in the field, the periodic removal of an oil sample and analysis of the gas content serve to monitor the condition of transformers and other oil-filled equipment.

The importance of these techniques has led to the preparation of this document, to the procedures used for the sampling, from oil-filled electrical equipment, of gases and oils containing gases, and for subsequent analysis.

NOTE Methods described in this document apply to insulating oils, since experience to date has been almost entirely with such oils. The methods ~~may~~ can also be applied to other insulating liquids, in some cases with modifications.

General caution, health, safety and environmental protection

WARNING – This document does not purport to address all the safety problems associated with its use. It is the responsibility of the user of this document to establish appropriate health and safety practices and determine the applicability of regulatory limitations prior to use.

The insulating oils which are the subject of this document should be handled with due regard to personal hygiene. Direct contact with the eyes ~~may~~ can cause irritation. In the case of eye contact, irrigation with copious quantities of clean running water should be carried out and medical advice sought. Some of the tests specified in this document involve the use of processes that ~~could~~ can lead to a hazardous situation. Attention is drawn to the relevant standard for guidance.

Mercury presents an environmental and health hazard. Any spillage should immediately be removed and be properly disposed of. ~~Consult local regulations~~ Regulatory requirements for mercury use and handling can apply. Mercury-free methods may be requested in some countries.

Environment

WARNING – This document is applicable to insulating oils, chemicals and used sample containers.

Attention is drawn to the fact that, at the time of writing of this document, many insulating oils in service are known to be contaminated to some degree by polychlorinated biphenyls (PCBs). If this is the case, safety countermeasures should be taken to avoid risks to workers, the public and the environment during the life of the equipment, by strictly controlling spills and emissions. Disposal or decontamination of these oils ~~should be carried out strictly according to local regulations~~ can be subject to regulatory requirements. Every precaution should be taken to prevent the release of any type of insulating oil into the environment, including those partially biodegradable with time.

OIL-FILLED ELECTRICAL EQUIPMENT – SAMPLING OF FREE GASES AND ANALYSIS OF FREE AND DISSOLVED GASES IN MINERAL OILS AND OTHER INSULATING LIQUIDS – GUIDANCE

1 Scope

This document deals with the techniques for sampling free gases from gas-collecting relays from power transformers. Three methods of sampling free gases are described.

The techniques for sampling oil from oil-filled equipment such as power and instrument transformers, reactors, bushings, oil-filled cables and oil-filled tank-type capacitors are no longer covered by this document, but are instead described in IEC 60475:~~2011~~2022, 4.2.

Before analysing the gases dissolved in oil, they are first extracted from the oil. Three basic methods are described, one using extraction by vacuum (Toepler and partial degassing), another by displacement of the dissolved gases by bubbling the carrier gas through the oil sample (stripping) and the last one by partition of gases between the oil sample and a small volume of the carrier gas (headspace). The gases are analysed quantitatively after extraction by gas chromatography; a method of analysis is described. Free gases from gas-collecting relays are analysed without preliminary treatment.

The preferred method for ensuring the performance of the gas extraction and analysis equipment, considered together as a single system, is to degas samples of oil prepared in the laboratory and containing known concentrations of gases ("gas-in-oil standards") and quantitatively analyse the gases extracted. Two methods of preparing gas-in-oil standards are described.

For daily calibration checks of the chromatograph, it is convenient to use a standard gas mixture containing a suitable known amount of each of the gas components to be in a similar ratio to the common ratios of the gases extracted from transformer oils.

The techniques described take account, on the one hand, of the problems peculiar to analyses associated with acceptance testing in the factory, where gas contents of oil are generally very low and, on the other hand, of the problems imposed by monitoring equipment in the field, where transport of samples ~~may~~ can be by un-pressurized air freight and where considerable differences in ambient temperature ~~may~~ can exist between the plant and the examining laboratory.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60296, *Fluids for electrotechnical applications – ~~Unused Mineral insulating oils for transformers and switchgear~~ Mineral insulating oils for electrical equipment*

IEC 60475:~~2011~~2022, *Method of sampling insulating liquids*

~~IEC 60599, *Mineral oil-impregnated electrical equipment in service – Guide to the interpretation of dissolved and free gases analysis*~~

~~ISO 5725 (all parts), *Accuracy (trueness and precision) of measurement methods and results*~~

ISO 5725-1, *Accuracy (trueness and precision) of measurement methods and results – Part 1: General principles and definitions*

~~ASTM D2780, *Standard Test Method for Solubility of Fixed Gases in Liquids*~~

SVENSK STANDARD

SS-EN IEC 60567, utg 4:2024

Fastställd	Sida	Ansvarig kommitté
2024-09-25	1 (65)	SEK TK 10

Oljefylld elektrisk utrustning – Provtagning på gas och olja för analys av fria och lösta gaser - Vägledning

Oil-filled electrical equipment – Sampling of gases and analysis of free and dissolved gases – Guidance

Som svensk standard gäller europastandarden EN IEC 60567:2024. Den svenska standarden innehåller den officiella engelska språkversionen av EN IEC 60567:2024.

Nationellt förord

Europastandarden EN IEC 60567:2024

består av:

– **europastandardens ikraftsättningsdokument,** utarbetat inom CENELEC
– **IEC 60567, Fifth edition, 2023 - Oil-filled electrical equipment – Sampling of gases and analysis of free and dissolved gases – Guidance**

utarbetad inom International Electrotechnical Commission, IEC.

Tidigare fastställd svensk standard SS-EN 60567, utg 3:2012 med eventuella tillägg, ändringar och rättelser gäller ej fr o m 2027-01-12.

ICS 29.040.10

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Postadress: Box 1042, 172 21 Sundbyberg
Telefon: 08 - 444 14 00.
E-post: sek@elstandard.se. Internet: elstandard.se

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Det finns många fördelar med att ha gemensamma tekniska regler för bl a mätning, säkerhet och provning och för utförande, skötsel och dokumentation av elprodukter och elanläggningar.

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Var med och påverka!

Den som deltar i SEKs tekniska kommittéarbete har möjlighet att påverka framtida standarder och får tidig tillgång till information och dokumentation om utvecklingen inom sitt teknikområde. Arbetet och kontakterna med kollegor, kunder och konkurrenter kan gynnsamt påverka enskilda företags affärsutveckling och bidrar till deltagarnas egen kompetensutveckling.

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elstandard.se

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN IEC 60567

January 2024

ICS 29.040.10

Supersedes EN 60567:2011

English Version

Oil-filled electrical equipment - Sampling of free gases and analysis of free and dissolved gases in mineral oils and other insulating liquids - Guidance (IEC 60567:2023)

Matériels électriques immergés - Échantillonnage de gaz libres et analyse des gaz libres et dissous dans les huiles minérales et d'autres liquides isolants - Recommandations (IEC 60567:2023)

Ölgefüllte elektrische Betriebsmittel - Probenahme von freien Gasen und Analyse von freien und gelösten Gasen in Mineralölen und anderen Isolierflüssigkeiten - Anleitung (IEC 60567:2023)

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

Ref. No. EN IEC 60567:2024 E

SEK Svensk Elstandard

SS-EN IEC 60567, utg 4:2024

European foreword

The text of document 10/1207/FDIS, future edition 5 of IEC 60567, prepared by IEC/TC 10 "Fluids for electrotechnical applications" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN IEC 60567:2024.

The following dates are fixed:

- latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2024-10-12
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2027-01-12

This document supersedes EN 60567:2011 and all of its amendments and corrigenda (if any).

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Endorsement notice

The text of the International Standard IEC 60567:2023 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standard indicated:

IEC 60599 NOTE Approved as EN IEC 60599

ISO/IEC 17025 NOTE Approved as EN ISO/IEC 17025

ISO 3675 NOTE Approved as EN ISO 3675

Annex ZA
(normative)

Normative references to international publications with their corresponding European publications

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NOTE 1 Where an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cencenelec.eu.

Publication	Year	Title	EN/HD	Year
IEC 60296	-	Fluids for electrotechnical applications - Mineral insulating oils for electrical equipment	EN IEC 60296	-
IEC 60475	2022	Method of sampling insulating liquids	EN IEC 60475	2022
ISO 5725-1	-	Accuracy (trueness and precision) of measurement methods and results - Part 1: General principles and definitions	-	-

IEC 60567

Edition 5.0 2023-12

INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

Oil-filled electrical equipment – Sampling of free gases and analysis of free and dissolved gases in mineral oils and other insulating liquids – Guidance

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IEC 60567:2023-12(en-fr)

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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The techniques for sampling oil from oil-filled equipment such as power and instrument transformers, reactors, bushings, oil-filled cables and oil-filled tank-type capacitors are no longer covered by this document, but are instead described in IEC 60475:2022, 4.2.

Before analysing the gases dissolved in oil, they are first extracted from the oil. Three basic methods are described, one using extraction by vacuum (Toepler and partial degassing), another by displacement of the dissolved gases by bubbling the carrier gas through the oil sample (stripping) and the last one by partition of gases between the oil sample and a small volume of the carrier gas (headspace). The gases are analysed quantitatively after extraction by gas chromatography; a method of analysis is described. Free gases from gas-collecting relays are analysed without preliminary treatment.

The preferred method for ensuring the performance of the gas extraction and analysis equipment, considered together as a single system, is to degas samples of oil prepared in the laboratory and containing known concentrations of gases ("gas-in-oil standards") and quantitatively analyse the gases extracted. Two methods of preparing gas-in-oil standards are described.

For daily calibration checks of the chromatograph, it is convenient to use a standard gas mixture containing a suitable known amount of each of the gas components to be in a similar ratio to the common ratios of the gases extracted from transformer oils.

The techniques described take account, on the one hand, of the problems peculiar to analyses associated with acceptance testing in the factory, where gas contents of oil are generally very low and, on the other hand, of the problems imposed by monitoring equipment in the field, where transport of samples can be by un-pressurized air freight and where considerable differences in ambient temperature can exist between the plant and the examining laboratory.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60296, *Fluids for electrotechnical applications – Mineral insulating oils for electrical equipment*

IEC 60475:2022, *Method of sampling insulating liquids*

ISO 5725-1, *Accuracy (trueness and precision) of measurement methods and results – Part 1: General principles and definitions*